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ABSTRACT

Compared were performances of 12 educable mentally retarded (EMR) and 12 normal children in grade 6 on a perceptual learning task to determine whether individuals with different intelligence levels have different learning abilities. A protable minicomputer was used to present "old letters" (usual lower case letters) and "new letters" (letter-like figures consisting of vertical lines and shorter horizontal lines) on a screen alternately in 10 trial blocks during 21 days. The computer automatically calculated a student's response latency and errors for four conditions (successive and simultaneous old and new letters). Results of statistical analysis indicated no significant differences between the groups in their central processing of information on the four task conditions, and significantly higher latencies for the EMR group. Both groups improved with practice. The differences in attention, orientation to the stimulus response selection, and speed of motor activities were thought to account for the differences between normal and EMR retarded children. (MC)

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A Comparison of Normal and Mentally Retarded Children on a Perceptual Learning Task[1]

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This investigation was undertaken with the general aim of studying an important aspect of reading - the perceptual processing and learning of information. A more specific aim was to compare the performance over time on a perceptual learning task of children classified on the basis of an intelligence test as either normal or mentally retarded (MR).

Intelligence tests have been faulted in recent years by Rohwer (1971) and other researchers as being tests of prior learning rather than measures of general learning ability. Several different laboratory studies of retention (e.g. Underwood, 1954; Shuell and Keppel, 1970) have found that when the degree of original learning is controlled, there are no differences in retention between individuals who differ in IQ. In 1963, Zeaman and House compared three groups of retarded learners on a discrimination task. Each group differed in IQ. The study found no difference in the learning acquisition curves once the critical dimensions of the different stimuli were noticed. Estes (1970) noted that the Zeaman and House study implied that although individuals of differing intelligence levels may show different habits of attention and stimulus selection, they "do not differ greatly with respect to learning ability in the sense of rate of formation of associations or retention of associations once formed." (p. 166, Estes, 1970). The objective of the present investigation was to test Estes' contention that there is no difference in the basic learning ability of individuals of differing levels of intelligence. The study explored the acquisition phase of perceptually learned discriminations.

Method

Subjects

The experimental group consisted of all twelve children in a sixth grade (based on chronological age (CA)) classroom for the mentally retarded. The

control group was composed of twelve sixth graders randomly selected from other classrooms in the same middle-class school. The mean age of both groups was 12 years. Since the school had a policy of not recording individual IQ scores of the pupils, such scores were unavailable. However, information was obtained that the IQ's of the twelve children in the MR classroom ranged from 56 to 80 with a mean IQ of 69. Although it is not known by exactly how much the 2 groups differed in IQ scores, it was known that, on the basis of their scores, twelve of the children were classified by the school as normal and twelve were classified as mentally retarded. The two groups of subjects were thus equated for CA but differed in IQ level.

Materials and Procedures

The task consisted of same-different discriminations of letter and letter-like figures. A portable minicomputer unit (P-L systems Audio-visual Trainer) that could be transported to and from the school was used. The unit contained a carousel projector that flashed slides onto a television-like display screen. Timing of the slide presentations and recording of both response accuracy and latency were under the control of the computer unit.

Stimuli were always presented on two succeeding slides with the first stimulus (the cue) appearing in the top half of the screen and the second stimulus (the target) appearing in the lower half of the screen. The cue remained on the screen for one second with a second between slides. The target remained displayed for two seconds unless terminated sooner by a button press. Subjects responded to the target using a Donders-c response method. They pressed a button held in the preferred hand if the target matched the prior cue (successive condition) or if two target stimuli were present that matched each other (simultaneous condition). Thus, subjects pressed the button if the stimuli were the same, but did not respond if the stimuli were different. Feedback occurred automatically after each trial as either a flash of blue light indicating a correct response or

a flash of red light indicating an error.

Two kinds of stimuli were used. "Old" letters were the lower case b,d, p, and q that were familiar to both groups. "New" letters were the letter-like forms ꟻ,ꟼ,ꟽ,ꟾ that were unfamiliar to both groups. Trial blocks of "old" and "new" letters were shown on alternate days to a total of ten trial blocks each (twenty days of testing).

Two modes of presentation were used: 1) successive - in which the target stimulus was compared with a previously presented cue stimulus and 2) simultaneous - in which two target stimuli were compared with each other disregarding the cue stimulus. On any one trial the stimuli appeared as either a successive match, a successive mismatch, a simultaneous match or a simultaneous mismatch. (See Figure 1)

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Figure 1 About Here
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The computer automatically calculated the individual's mean response latency and errors for successive and simultaneous conditions separately and printed them at the end of the trial block (34 trials).

The print out was explained to the child and served as feedback on latency as well as accuracy and also as reinforcement.

Each day the subjects received one trial block of test stimuli plus a trial block designed to measure basic reaction time (BRT). The BRT trial block consisted of non-task stimuli (checkmarks) interspersed among blank slides with instructions to respond to any stimulus, but not to any blanks. This furnished a baseline measure of each individual's reaction time when no same-different decision was involved. The child merely reacted to the presence of a stimulus.

Design

A one-between three-within repeated measures design was used. Factors were:

A) Group (MR or normal), B) Letters (old or new), C) Presentation mode (successive or simultaneous) and D) Replications. Three dependent variables were analyzed: Daily mean latencies, Adjusted latencies (Latency minus baseline RT) and Accuracy.

Results and Conclusions

The initial analysis of variance showed a highly significant A (Group) effect for Latency ($F_{1,22} = 12.19$, $p < .01$) and Accuracy ($F_{1,22} = 17.84$, $p < .01$) but no significant Group effect for Adjusted Latencies. The B, C and D effects were all highly significant ($p < .01$) for all 3 dependent variables. To investigate some interactions, a further 2-way ANOVA was run on each dependent variable for factors A and D at each BC condition. Again no significant Group effect for Adjusted Latencies was found at any BC condition. On examining the significant group effect for Mean Latencies, the latencies of the MR group were consistently higher than those of the normal group, with both groups improving with practice. The linear functions thus differed in Y-intercept, but not in slope.

The mean response latency on this task presumably includes time required to orient to the stimulus, receive and store visual information, compare stimuli or match visual information to the memory of prior stimuli (i.e. central processing), select an appropriate response and, finally, produce the motor activity of the response. The time required for central processing (the actual comparison time in a same-different task) can be represented by the slope constant and separated from the time required for stimulus preprocessing, response selection and response execution that is represented by the y-intercept (Briggs and Blaha, 1969). Thus, when the baseline RT measure which involved no internal processing for comparisons was subtracted from overall latency, it corrected for differences in the time necessary to orient to the stimulus and select and perform the motor response. These adjusted latencies showed no significant differences between the groups in their central processing of information.

These results support the Estes and Zeaman and House position and the major hypothesis of this experiment that there are no differences in the basic learning ability of normal and MR children. It would appear that differences that were found between the groups resulted not from any variation in the basic internal processing of information, but rather from differences in attention and orientation to the stimulus, response selection and speed of motor activities.

As further evidence that the central processing of the tasks is similar for normal and retarded children, the four task conditions (successive "old" letters, suggessive "new" letters, simultaneous "old" letters and simultaneous "new" letters) have the same order of difficulty and order of processing speeds for both groups. In other words, the condition which is easiest for the normal group is also the easiest for the MR group. The condition under which the normal group has the lowest mean response latency is the same condition under which the MR group shows its lowest mean response latency and these four conditions remain in the same relative positions in both groups over time.

Educational implications and scientific importance

The results of this study imply that although mentally retarded children may not differ in basic learning ability, they may have trouble orienting to the correct stimulus or focusing attention on the critical dimensions of a task. Thus, teachers can help retarded children by specifically pointing out and indicating very concretely exactly what the critical factors of a learning task are.

A recent study by Katz and Wicklund (1970) compared simple reaction times of good and poor readers in the sixth grade and found no differences in reaction time attributable to stimulus orientation or motor performance. They concluded that original differences found between good and poor readers may have been caused by differences in the speed of choosing an appropriate response. Data from our investigation, unlike that of Katz and Wicklund, did show a significant difference between the baseline RT's of MR's and normals ($T_{22}df = 7.9$, $p < .01$)

The discrepancy between these findings may be due to the following reasons. First, there were slight differences in the basic reaction time task. Second, the good and poor readers of Katz and Wicklund's study were both within the normal range on intelligence tests. Alternatively, the main difference between good and poor readers and normal and retarded children may be in the amount of time required for response selection and decoding. Further investigation of this topic is planned.

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Figure 1: "Old" Letters. Four possible cue-target combinations.